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RESPONSE OF BARLEY TO INTERCROPPING WITH SUGAR BEET UNDER DIFFERENT NITROGEN FERTILIZATION LEVELS.

Khedr, A. H.* and E. A. E. Nemeat Alla**
* Field Crops Res. Inst., Agric. Res. Center, Giza.
** Sugar Crops Res. Inst., Agric. Res. Center, Giza.

ABSTRACT

Two field experiments were carried out during 2003/2004 and 2004/ 2005 seasons to study the effect of some intercropping patterns of barley with sugar beet under three levels of N fertilizer on yield and yield components of sugar beet and barley. The intercropping patterns were planting barley on sugar beet beds (120 cm wide) in 3, 4 and 5 rows; representing 37.5, 50 and 62.5 % of the barley sole crop which was grown on eight rows. N levels were 60, 80 and 100 kg N/ fed. Sugar beet was planting on the bed representing 100 % of sole crop. A split plot design was used with three replications. The obtained results could be summarized as follows:
Sugar beet : Intercropping systems significantly reduced root length, root diameter, root weight, roots yield and sugar yield/ fed with increasing number of intercropping rows of barley. Increasing N fertilizer levels from 60kg N/fed up to 100kg N/fed significantly increased root length, diameter, weight and sugar yield/ fed. Interaction effect of intercropping barley with sugar beet recorded the highest values for the previous traits with intercropping system of 3- rows and adding 100 kg N/ fed, while the lowest values were recorded with intercropping 5- rows and adding 60 kg N/ fed.
Barley : Intercropping systems significantly reduced plant height, spike length, number of grain/spike, grains weight/spike and weight of 1000 grains with increasing number of intercropping rows of barley. On the other hand, grains and straw yield/ fed were increased by increasing number of intercropping barley from 3- rows up to 5- rows. Increasing N fertilizer levels from 60 kg N/fed up to 100 kg N /fed significantly increased all the previous traits of barley. The highest values for weight i.e. 1000-grain, grains and straw yield/ fed with intercropping system of 5 rows and adding 100 kg N/ fed, while the lowest values were recorded with intercropping 3 rows and adding 60 kg N/ fed. Competitive relationships: Land Equivalent Ratio (LER) was increased by 42 – 55% when barley intercropped with sugar beet over monocultures of both crops. Relative Crowding Coefficient (RCC) of sugar beet and barley increased with the pattern of 3-rows which gave the highest RCC value (22.76) whereas the lowest value was recorded with pattern of 4-rows (11.98). Sugar beet plants had positive values of aggressively (dominant crop), Whereas barley had negative effect (dominated crop) under the three intercropping systems.
Keywords: Intercropping patterns of (3, 4 and 5 rows) increased markedly farmer net income by 454.08, 460.56 and 522.60 L.E., respectively.

INTRODUCTION

Nowadays, the food production of the cultivated area in Egypt is low, the government imports large amounts of food to cover the gap between production and consumption, which presses hard on the budget . The need for food will grow in the future with the ever growing population. Therefore, growing two or more crops simultaneously on the same area, may be considered one of the most effective practice followed in Egypt to meet the limited cultivated area, in addition to increasing the production per unit area, intercropping barley with sugar beet may allow better utilization of the

available growth factors without considerable reduction in beet or barley production .

Amer *et al*, (1997), found that planting of faba been at 70% of its solid population intercropped with 100%sugar beet gave the highest income value, while 50% faba been population and 100% sugar beet gave the lowest value . Vandermeer (1989), found that different root systems of the combined crops are of advantage to higher final yield crops, use nutrients from different depth of the soil and competition is reduced. Many investigators found that the land use efficiency was increased and yield advantage was produced by intercropping faba been with barley (Abo – Shetaia, 1990 and Ebaid, 1991), and wheat (Ali *et al*, 1986, Saleh *et al*, 1986, Abd El Gawad *et al*, (1988a), and Beshay *et al*, 2000). Also, several studies were performance the effects on yield and yield components of sugar beet due to type of soil and intercropping patterns. Toaima *et al* (2001), proved that the aggressivety (A) for sugar beet was dominant with both intercropping models (ridges 60 and 120 cm. wide), whereas, it was dominated with onion and garlic intercropped with sugar beet.

Nitrogen fertilizer has contributed greatly to improve most of characters under study for both crops with increasing N levels up to 100 kg N/fed. Compared to lowest N level (60 kg N/fad). In this concem, Kass (1978), revealed that nutrient elements such as p, k and Ca when available in greater amounts result in less crop competition under intercropping. Ismail (2002) and Gamal (2005) found that nitrogen levels significantly affected root diameter, root fresh weight and roots and sugar yields EL- Hag (2001) and Rania (2004) in Egypt, found that increasing nitrogen level up to 60 kg/fed. Significantly increased plant hight, spike length, number of grains /spike and biological grain and straw yields of barley/fed.

The present investigation was planed to study the possibility of intercropping barley with sugar beet under different nitrogen levels and the response of yield and its components of both sugar beet and barley as well as to determined the competitive relationship and yield advantages for the two crops.

MATERIALS AND METHODS

This study was conducted in the Experimental Farm of Agricultural Research Station at Sakha, kafer El–sheikh governorate, during (2003/2004 and 2004/2005) seasons to study the effect of intercropping barley (c.v.123, early maturity and high yielding) with sugar beet (*Beta Vulgaris* Var top) on yield and yield components for both crops, also, to explore degree of competition between sugar beet and barley under different intercropping patterns and different nitrogen levels. Chemical analysis of soil experimental site in Table 1.

Each experiment included fifteen treatments which were three nitrogen fertilizer levels (60, 80 and 100 kg N/fed.) and five intercropping systems, i.e.

1. Planting three rows of barley on sugar beet bed.
2. Planting four rows of barley on sugar beet bed.
3. Planting five rows of barley on sugar beet bed.

4. Planting sugar beet alone.
5. Planting barley alone.

Table 1: Chemical analysis of the soil experimental site (0-30 cm depth) at farm of Sakha research Station, Kafr El-Sheikh in 2003/2004 and 2004/2005 seasons.

Seasons	pH (1:2.5)	EC m mhos/ cm	Organic matte %	Available			Anions q/L			
				N ppm	P ppm	K ppm	HCO_3^-	Cl^-	$SO4^-$	$CO3^-$
2003/2004	8.3	3.34	1.82	15.50	6.31	281.35	6.5	6.1	0.21	0.0
2004/2005	8.4	3.40	1.91	16.30	6.25	290.10	6.1	5.9	0.15	0.0

The treatments arranged in split plot design with three replications where the intercropping treatments were randomly occupied the main plots and the nitrogen levels were randomly allocated in the sub plots. The consisted of 5 beds 3.5 m. length and 1.2 m. width (21m ^{2}).

Sugar beet was seeded by hand in fixed number of hills (spacing within hills 20 cm. on both sides of 1.2 m. width bed) to gave population of 35000 plant /fed. Beet was planted on October 15th and 18th in 2003 and 2004 seasons, respectively. Beet hills were thinned after 30 days from sowing to one plant per hill and the grain of barley were drilled on back beet beds on November 30 and December 3 in 2003 and 2004 seasons, respectively (45 days after beet planting) in three patterns i.e. three, four and five rows, spacing between rows were 15 cm and within row the hills spacing were 10 cm, to gave 37.5%, 50% and 62.5% of the solid crop, respectively. Also, both crops alone were sown on the same ridges.

Potassium sulphate (50% K_2O) at the rate of 50 kg/ Fed. was added during land preparation, calcium superphosphate fertilizer (15.0 % P_2O_5) was added at a rate of 100 kg./fed. before sowing. Nitrogen fertilizer was added according to the treatments as ammonium nitrate (33.5% N) in three equal doses, the first one after thinning of beet and the second dose at planting barley and the third one month later. All other cultural practices were applied as recommended for each crop in the region. In the both seasons beet was preceded by cotton (*Gossypium barbadence L.*).

At maturity, each crop was harvested separately and ten plants for each crop were randomly selected from each sub plot to determine yield components of both crops.

- **Sugar beet:** Root length (cm), root diameter (cm), root weight/ plant (gm), however roots yield/ fed (ton) and sugar yield (ton/ fed.) were calculated from all sub-plot plant.
- **Barley:** Plant height (cm), spike length (cm), number of grains/ spike, weight of spike (gm), grains weight/spike (gm), weight of 1000 grains (gm), however grains yield/ fed (ton), as well as weight of straw yield/ fed (ton) were calculated from all sub-plot plants.

In order to have knowledge about the degree of competition sugar beet and barley plants. The following parameters were calculated:

1. **Land equivalent ratio (LER):** This was determined according to Willey and Osiru (1972).

$$\text{L beet} = \frac{\text{Intercrop yield of beet}}{\text{Pure stand yield of beet}} \quad \text{L barley} = \frac{\text{Intercrop yield of barley}}{\text{Pure stand yield of barley}}$$

LER = L beet + L barley = the sum of the fractions of the yield of intercrop relative to their sole crop yield.

2. **Relative crowding coefficient (k):** it was calculated for sugar beet (k s) and barley (k b) and the two crops (k) according to Hall (1974).

$$Ks = \frac{Ysb \times Zbs}{(Yss - Ysb) \times Zsb} \qquad Kb = \frac{Ybs \times Zsb}{(Ybb - Ybs) \times Zbs}$$

K = Ks x Kb = relative crowding coefficient for both crops .

If K > 1 there is a yield advantage, if k = 1 there is no advantage to intercropping and if K < 1 there is a yield disadvantage.

Where : Yss = Pure stand yield of sugar beet.
Ybb = Pure stand yield of barley.
Ysb = Mixture yield of sugar beet (in combination with barley).
Ybs = Mixture yield of barley (in combination with sugar beet).
Zsb = Sown proportion of sugar beet (in mixture with barley).
Zbs = Sown proportion of barley (in mixture with sugar beet) .
K = Relation crowding coefficient for both crops.

3. **Aggressivity (A):** was determined according to Mc-Gilchrist (1965) for other combination.

$$As = \frac{Ysb}{Yss \times Zsb} - \frac{Ybs}{Ybb \times Zbs}$$

$$Ab = \frac{Ybs}{Ybb \times Zbs} - \frac{Ysb}{Yss \times Zsb}$$

Where : As = aggressivity value for sugar beet.
Ab = aggressivity value for barley.

An aggressively value of zero, indicates that the component of both crops are equally competitive for any other situation, both crops will have the same numerical value, but the sign of the dominant crop will be positive and that of dominated will be negative .

4. Economical Evaluation:

The total income from each treatment was calculated in Egyptian pound/ ton at market price of L.E./ton of sugar beet and L.E./ton of barley as grains according to ministry of Agriculture price.

Data collected were statistically analyzed according to Gomez and Gomez (1984) for two seasons and their combination and means were compared by Least Significant Differences (L.S.D) at 5 % level.

RESULTS AND DISCUSSION

1. Sugar beet:

1.1. Effect of intercropping systems:

Results in Table 2 revealed the intercropping systems of barley with sugar beet on yield, yield components and sugar yield/ fed of sugar beet. Root length, root diameter and root weight/plant were significantly reduced

with increasing intercropping systems from 3 to 5 rows. Generally, sugar beet sole crop was higher values than were collected from sugar beet intercropping. These results may be due to inter specific competition between sugar beet plants and intra specific between barley and sugar beet plants. These data are in agreement with those recorded by Amer *et al*; (1997). As well as, Data illustrated that roots yield/ fed significantly decreased with increasing intercropping from 3 to 5 rows. The yield/ fed, compared to sugar beet sole crop decreased by 3.87, 9.68 and 12.33% in combined data analysis, respectively. These results are in accordance with those obtained by Toaima *et al*; (2001).

Table 2: Effect of intercropping barley with sugar beet on yield and yield components of sugar beet.

Traits / Inter-cropping systems	Root length (cm)	Root diameter (cm)	Root weight/ plant (gm)	Roots yield/ fed (ton)	Sugar yields/ fed (ton)
	2003/2004 season				
3 rows planted on bed	30.08	36.27	708.33	23.28	4.12
4 rows planted on bed	28.70	35.50	668.85	21.85	3.78
5 rows planted on bed	28.50	35.04	640.27	21.28	3.65
Sole crop	30.89	36.82	805.09	24.20	4.37
L S D at 0.05	0.77	0.39	26.94	1.68	0.10
	2004/2005 Season				
3 rows planted on bed	30.42	36.25	670.67	22.99	4.18
4 rows planted on bed	28.75	35.55	637.22	21.63	3.85
5 rows planted on bed	28.25	34.78	566.28	20.93	3.71
Sole crop	30.57	36.70	722.92	23.61	4.34
L S D at 0.05	NS	0.15	16.69	0.21	0.24
	Data combined				
3 rows planted on bed	30.25	36.26	689.50	23.138	4.15
4 rows planted on bed	28.70	35.52	653.03	21.740	3.82
5 rows planted on bed	28.38	34.91	603.28	21.103	3.68
Sole crop	30.73	36.76	764.00	24.070	4.35
L S D at 0.05	0.73	0.19	10.94	0.536	0.13

1.2. Effect of N fertilizer levels:

Data in Table (3) indicated the effect of nitrogen levels on sugar beet yield, yield components and sugar yield/ fed. Root length, root diameter and root yield/ plant were significantly increased by increasing N level from 60 kg N/ fed up to 100 kg N/fed. These results may be due to lower competition between sugar beet plants when increasing N level (Kass 1978), as well as, use nutrients from different parts of the soil (Vandermeer 1989).

With respect to roots yield/ fed, data revealed that increasing roots yield/fed with increasing N levels up to 100 kg N/fed. The increase in roots yield/fed, compared to the lowest N level (60 kg/ fed) were 2.13 and 4.54 % when adding 80 and 100 kg N/ fed, in combined data analysis, respectively.

As for sugar yield/fed, data were significantly increased by increased N levels. The increase in sugar yield/fed were 3.36 and 6.72 %, respectively.

This results are in line with those reported by Ismail (2002) and Gamal (2005).

Table 3: Effect of N fertilizer rates on sugar beet yield and yield components.

Traits / Nitrogen levels	Root Length (cm)	Root diameter (cm)	Root Weight (gm)	Roots yield/ fed (ton)	Sugar yields/ fed (ton)
	2003/2004 season				
60 kg/ fed	27.84	35.62	683.44	22.03	2.85
80 kg/ fed	29.69	35.85	707.60	22.61	4.03
100 kg/ fed	31.00	36.00	726.70	23.32	4.10
L S D at 0.05	0.45	0.25	18.31	0.38	0.11
	2004/2005 Season				
60 kg/ fed	28.35	35.54	634.85	22.01	3.87
80 kg/ fed	28.89	36.05	650.95	22.38	3.97
100 kg/ fed	31.34	36.10	662.02	22.73	4.15
L S D at 0.05	1.54	NS	4.09	0.19	0.17
	Data combined				
60 kg/ fed	28.09	35.58	658.73	22.02	3.87
80 kg/ fed	29.29	35.95	679.27	22.49	4.00
100 kg/ fed	31.17	36.05	694.37	23.02	4.13
L S D at 0.05	0.89	0.26	10.93	0.16	0.12

1-3: Interaction effect:

Results in Table 4 show the effect of interaction effect of intercropping systems X N levels on sugar beet root length, root diameter, root weight. roots yield/ fed and sugar yield/ fed as combined data analysis. The highest values were obtained when intercropping system was 3 rows and 100 kg N/fed. The highest values for sugar beet roots and sugar yield/ fed were 23.76 and 4.31 ton/ fed, while the lowest values were recorded with intercropping system of 5 rows and 60 kg N/ fed (20.56 and 3.53 ton/ fed).

Table 4: Interaction effect of intercropping systems with N fertilizer rates on sugar beet yield and yield components.

Treatments / Traits		Root length (cm)	Root diameter (cm)	Root weight (gm)	Roots yield/fed (ton)	Sugar yields/fed (ton)
60 kg N/ fed	3 rows	28.35	36.16	667.35	22.54	3.98
	4 rows	26.80	35.35	634.19	21.36	3.72
	5 rows	26.45	34.80	587.11	20.56	3.53
Sugar beet sole crop		30.75	36.00	746.27	23.64	4.25
80 kg N/ fed	3 rows	30.25	36.22	692.48	23.11	4.16
	4 rows	29.10	35.62	653.20	21.65	3.81
	5 rows	28.00	34.87	603.66	21.12	3.67
Sugar beet sole crop		29.80	37.10	767.72	24.07	4.36
100 kg N/ fed	3 rows	32.15	36.40	708.68	23.76	4.31
	4 rows	30.20	35.58	671.71	22.21	3.94
	5 rows	30.70	35.05	619.07	21.63	3.83
Sugar beet sole crop		31.65	37.18	778.02	24.49	4.44
L. S. D. at 0.05		NS	0.39	13.69	0.56	0.11

Pure stand of beet produced higher root yield/fed., compared to sugar beet produced by intercropping systems. Similar results were obtained by Beshay, *et al*, (2000).

For sugar beet. The increase in yield of this pattern mainly attributed to the low competition between beet and barley plants for light, water and nutrients. Barley plants provided a sparse canopy to beet plants. So plants are able to intercept and utilize solar energy similar solid canopy of beet. This may lead to increased photosynthetic activity and amount of metabolites synthesized. Such condition encourages the production of roots (Vandermeer 1989).

2. Barley:

2.1. Effect of intercropping systems:

Results in Table 5 show the effect of intercropping systems of barley with sugar beet on barley it's and yield components. Plant height was not significantly affected by intercropping systems in the first season only, as well as, insignificant effect was observed between barley as sale crop plants and plants intercropped, that is means, in competition effect for intra specific (between barley plants) and in competition effect for inter specific (between sugar beet plants and barley plants) were observed.

Table 5: Effect of intercropping systems of barley with sugar beet on yield and yield components of barley.

Traits / Intercropping systems	Plant height (cm)	Spike length (cm)	No. of grains /spike	Weight of spike (gm)	Grains weight/ spike (gm)	Weight of 1000 grain	Grains yield/fed (ton)	Straw yield/fed (ton)
	2003/2004 season							
3 rows	98.35	6.76	45.34	2.68	2.31	39.33	0.501	1.10
4 rows	98.15	6.54	43.40	2.64	2.26	38.29	0.665	2.03
5 rows	97.88	6.12	43.10	2.48	2.24	35.00	0.761	2.82
Barley sole crop	97.78	5.95	43.47	2.46	2.10	35.28	1.077	3.85
L.S.D. at 0.05	NS	0.13	0.21	0.05	0.07	0.62	0.050	0.44
	2004/2005 season							
3 rows	98.49	7.00	45.46	2.52	2.27	36.41	0.475	1.19
4 rows	98.11	6.82	43.18	2.50	2.17	35.19	0.547	2.06
5 rows	97.78	6.26	43.15	2.40	2.18	34.86	0.608	2.79
Barley sole crop	97.68	6.23	42.35	2.42	2.06	35.13	0.967	3.89
L.S.D. at 0.05	0.41	0.53	0.35	NS	0.08	0.16	0.025	0.12
	Data combined							
3 rows	98.42	6.88	45.40	2.60	2.29	37.88	0.488	1.16
4 rows	98.13	6.68	43.29	2 57	2.22	36.74	0.606	2.05
5 rows	97.83	6.19	43.13	2.44	2.21	34.94	0.685	2.81
Barley sole crop	97.73	6.09	42.41	2.44	2.08	35.21	1.022	3.87
L.S.D. at 0.05	0.34	0.31	0.19	0.06	0.07	0.27	0.036	0.42

With respect to spike length, number of grains/ spike, weight of spike, grains weight/spike and weight of 1000 grain, results showed that there were significantly reduced from intercropping 3 rows to 5 rows. These results are true due to lower plant population from 3 rows to 5 rows, lower competition

between plants for sun radiation, shadow and nutrient elements, hence increase the previous traits by reducing number of intercropping rows.

Grains yield/fed significantly increased with increasing intercropping systems from 3 rows to 5 rows. These results take the adverse trend of barley yield components due to increasing plant population/unit area. The yield were 47.75, 59.30 and 67.02 % ton/ fed of the solid crop in data combined with 3, 4 and 5 rows barley, respectively. Straw yield/ fed take the same trend of grains yield/fed. These results are in agreement with those recorded by Abo- Shetaia (1990).

2.2. Effect of nitrogen fertilizer levels:

Results in Table 6 show the effect of nitrogen levels on barley yield and its components. Plant height significantly increased with increasing N level. Plant height gradually increased by increasing N level from 60 up to 100 kg N/fed. These results are true due to increasing vegetative growth with increasing N fertilizer level.

With regard to yield components; spike length, number of grains/spike, weight of spike, grains weigh/ spike and grains yield/ fed, were increased by increasing N fertilizer level. these results are true due to increasing barley yield components with increasing N fertilizer level such finding agree with EL-Hag (2001) and Rania (2004) .

Table 6: **Effect of nitrogen fertilizer levels on yield and yield components of barley.**

Traits / Nitrogen levels	Plant height (cm)	Spike length (cm)	No. of grains/ spike	Weight of spike (gm)	Grains weight/ spike (gm)	Weight of 1000 grain	Grains yield/ fed (ton)	Straw yield/ fed (ton)
	2003/2004 season							
60 kg/ fed	96.76	6.10	42.90	2.50	2.17	36.58	0.713	2.22
80 kg/ fed	96.86	6.50	43.82	2.56	2.23	37.40	0.754	2.60
100 kg/ fed	101.18	6.56	43.86	2.60	2.31	38.14	0.786	2.80
L.S.D.at 0.05	1.34	0.35	0.11	0.04	NS	0.45	0.013	0.19
	2004/2005 season							
60 kg/ fed	94.36	6.32	43.12	2.42	2.13	34.77	0.625	2.14
80 kg/ fed	97.12	6.60	43.74	2.44	2.17	35.09	0.656	2.36
100 kg/ fed	101.88	6.68	43.98	2.50	2.19	35.20	0.673	2.68
L.S.D.at 0.05	0.43	NS	0.23	NS	NS	0.18	0.010	0.10
	Data combined							
60 kg/ fed	95.56	6.21	43.01	2.46	2.15	35.68	0.669	2.183
80 kg/ fed	96.99	6.55	43.76	2.50	2.20	36.24	0.720	2.480
100 kg/ fed	101.53	6.62	43.90	2.57	2.25	36.66	0.730	2.750
L.S.D.at 0.05	0.49	0.26	0.12	0.07	NS	0.20	0.012	0.14

Grains yield/ fed significantly increased due to increasing N fertilizer level up to 100 kg N/fed. These results are reflection for yield components of barley plants. The increase in grains yield/ fed were 7.62, 9.12 % for 80 and 100 kg N/fed, compared to the lowest N level (60 kg/fed) in combined data analysis, respectively. These results are in accordance with those obtained

by EL-Hag (2001) and Ramia (2004). Straw yield/ fed take the same trend of grains yield/ fed.

2.3. Interaction effect:

Results in Table 7 show the interaction effect of intercropping systems X N fertilizer levels on weight of 1000 grain, grains yield/fed and straw yield/fed as data combined. Results show that weight of 1000-grain was increased by increasing N level up to 100 kg N/fed. As well as, the values were reduced by increasing number of intercropping rows of barley. Grains yield/ fed was increased by increasing N fertilizer level and increased number of intercropping systems. The highest grains yield/fed were recorded with intercropping 5 rows with 100 kg N/fed. fertilizer (0.707 ton/fed), whereas the lowest values recorded with intercropping 3 rows with 60 kg N/fed (0.458 ton/fed). Straw yield/ fed take the same trend of grains yield/fed. These results are in agreement with those obtained by Ebaid (1991).

Table 7: Interaction effect of intercropping systems with N fertilizer rates on barley yield and yield components.

Traits		Weight of 1000 grains (gm)	Grains yield/fed (ton)	Straw yield/fed (ton)
Nitrogen fertilizer levels	Intercropping Systems			
60 kg N/ fed	3 rows	36.99	0.458	0.92
	4 rows	36.19	0.577	1.81
	5 rows	34.71	0.663	2.60
Barley sole crop		34.82	0.977	3.40
80 kg N/ fed	3 rows	38.09	0.496	1.20
	4 rows	36.73	0.607	2.15
	5 rows	34.96	0.684	2.72
Barley sole crop		35.17	1.021	3.85
100 kg N/ fed	3 rows	38.56	0.511	1.35
	4 rows	37.29	0.633	2.20
	5 rows	35.14	0.707	3.10
Barley sole crop		35.65	1.068	4.35
L. S. D. at 0.05		0.22	0.180	0.25

3. Competitive relationships:

Results in Table 8 show the effect of intercropping systems of sugar beet with barley on land equivalent ratio, Relative Crowding Coefficient (RCC) and Aggressively.

3.1. Land Equivalent Ratio (LER):

Land equivalent ratio was greater than one by intercropping sugar beet with barley of 3, 4 and 5 rows intercropping, that means yield advantage was produced and land usage was increased by intercropping barley with sugar beet for all intercropping systems; 44, 49 and 55 %, respectively.

3.2. Relative Crowding Co- efficient (RCC):

Results indicate that intercropping system of 3 rows gave the highest value of k (23.62). Sugar beet was the most contributor component than barley. Thus, there is a yield advantage to intercropping barley with sugar beet.

3.3. Aggressively:

Results revealed that sugar beet was the dominant crop, while barley was the dominated crop for all intercropping systems. The higher value of aggressivety for barley and sugar beet were obtained under 3 rows system. These results are in agreement with those obtained by Abo- Shetaia (1990).

Table 8: Competitive relationships of intercropping barley with sugar beet.

Competitive relationships / Intercropping systems	Yield/ fed (ton)		LER			RCC			Aggressively (A)	
	Sugar beet	Barley	Ls	Lb	LER	Rs	Rb	K	As	Ab
3 rows	23.14	0.488	0.96	0.48	1.44	15.5	0.91	14.15	+2.08	- 2.08
4 rows	21.74	0.606	0.90	0.59	1.49	4.66	1.46	6.80	+1.22	- 1.22
5 rows	21.10	0.685	0.88	0.67	1.55	2.66	5.44	14.47	+0.73	- 0.73
Sugar beet sole crop	24.07	—	—	—	—	—	—	—	—	—
Barley sole crop	—	1.022	—	—	—	—	—	—	—	—

4- Economical Evaluation:

Economical evaluation and net income of intercropping barly with sugar beet are presented in Table 9. Average of both seasons revealed that intercropping systems markedly increased farmers net income and profitability per unit capital input (L.E.) as compared with sugar beet growing in pure stand. Intercropping barley in 3, 4 or 5 rows on sugar beet beds maximized farmer net income by 452.28, 460.56 and 522.81 L.E over the average of both seasons. Similar results were recorded by E-Ammary *et al.*; (1999), Beshay *et al.*; (2000).

Table 9: Economical evaluation of intercropping barley with sugar beet (average of two seasons).

Traits / Intercropping systems	Yield/ fed (ton)			Total income L.E.	Net income L.E.
	Sugar beet	Barley			
		Grains	Straw		
3 rows	23.14	0.488	1.16	3824.08	452.28
4 rows	21.74	0.606	2.05	3830.36	460.56
5 rows	21.10	0.685	2.81	3892.60	522.81
Sugar beet sole crop	24.07	—	—	3369.80	—
Barley sole crop	—	1.022	3.87	1368.12	—

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استجابة الشعير للتحميل مع بنجر السكر تحت مستويات مختلفة من التسميد النيتروجيني

عبد الله حسين خضر[1] و السيد أحمد نعمة الله[2]
١- معهد بحوث المحاصيل الحقلية - مركز البحوث الزراعية
٢- معهد بحوث المحاصيل السكرية - مركز البحوث الزراعية

أقيمت تجربتان حقليتان موسمى ٢٠٠٣/٢٠٠٤ و ٢٠٠٤/٢٠٠٥ بالمزرعة البحثية لمحطة البحوث الزراعية بسخا - محافظة كفر الشيخ - وذلك لدراسة مدى استجابة الشعير للتحميل مع بنجر السكر تحت مستويات مختلفة من التسميد النيتروجيني على المحصول ومكوناته لكل من بنجر السكر والشعير . زرع الشعير فى ثلاث نظم تحميل (٣ سطور و ٤ سطور و ٥ سطور) على مصطبة بنجر السكر (١٢٠سم) تمثل ٣٧,٥ و ٥٠ و ٦٢,٥ % من المحصول النقى للشعير والذى زرع بمعدل ٨ سطور. استخدم السماد النيتروجينى فى ثلاث مستويات ٦٠ و ٨٠ و ١٠٠كجم نيتروجين/ف. وزرع البنجر على جانبى المصطبة ممثلا ١٠٠% من المحصول النقى. استخدم تصميم القطاعات المنشقة مرة واحدة فى ثلاث مكررات . وكانت النتائج المتحصل عليها الآتى :

بنجر السكر :

١- انخفض معنويا كل من طول وقطر ووزن الجذر ومحصول الجذور والسكر/فدان للبنجر بزيادة عدد سطور الشعير المنزرعة على مصاطب البنجر من ثلاث الى خمس سطور .

٢- ازدادت معنويا كل من طول وقطر ووزن الجذر ومحصول الجذور والسكر/فدان للبنجر بزيادة معدل التسميد النتروجيلى من ٦٠كجم/ف إلى ١٠٠كجم/ف

٣- سجل التفاعل بين نظام التحميل على ثلاث سطور من الشعير مع إضافة ١٠٠ كجم نيتروجين للفدان أعلى قيم لكل الصفات السابقة للبنجر بينما سجل التفاعل بين نظام التحميل على خمس سطور للشعير مع إضافة ٦٠كجم نيتروجين للفدان أقل قيم لمختلف الصفات أيضا.

الشعير :

١- انخفض كل من طول النبات و طول السنبلة وعدد الحبوب للسنبلة ووزن السنبلة ووزن حبوب السنبلة ووزن ال١٠٠٠ حبة معنويا بزيادة عدد سطور الشعير المحملة على مصاطب البنجر من ثلاث الى خمس سطور بينما ازداد معنويا كل من وزن الحبوب والتبن للفدان.

٢- ازدادت معنويا كل صفات المحصول ومكوناته للشعير بزيادة معدلات التسميد النتروجينى من ٦٠كجم/ف إلى ١٠٠كجم/ف

٣- سجل التفاعل بين نظام التحميل للشعير على خمس سطور مع إضافة ١٠٠كجم نيتروجين/ف أعلى قيم بينما سجل نظام التحميل على ثلاث سطور وإضافة ٦٠كجم نيتروجين /ف أقل القيم لوزن ال١٠٠٠ حبة ووزن محصول الحبوب والتبن للفدان .

العلاقات التنافسية :

أدى تحميل الشعير مع بنجر السكر إلى زيادة معدل استغلال الأرض بنسبة ٤٢ - ٥٥% مقارنة بالزراعة النقية لكلا المحصولين. سجل معدل التزاحم النسبى للبنجر والشعير أعلى القيم عند استخدام نظام التحميل على خمس سطور (١٤,٤٧) بينما أعطى نظام التحميل على اربع سطور أقل القيم (٦,٨٠). قيم المنافسة كانت موجبة للبنجر (المحصول السائد) بينما كان الشعير هو المحصول المسود لكل نظم التحميل . زاد العائد النقدى للمزارع فى الثلاث نظم تحميل الشعير مع بنجر السكر (٣سطور و ٤ سطور و٥ سطور) بـ ٤٥٠,٦٠ جنيه و ٤٤٣,٨٠ جنيه و٤٩٤,٠٠ جنيه على التوالى .

وتشير نتائج البحث الى أن نظام تحميل الشعير بمعدل خمسة سطور على مصاطب البنجر (١٢٠سم) مع إضافة السماد النيتروجينى بمعدل ١٠٠كجم/ف سجل أعلى عائد نقدى للمزارع تحت ظروف محافظة كفرالشيخ.